Universidad del Valle de Guatemala
Facultad de Ingeniería
Departamento de Ciencias de la Computación
Inteligencia Artificial

Tarea #3

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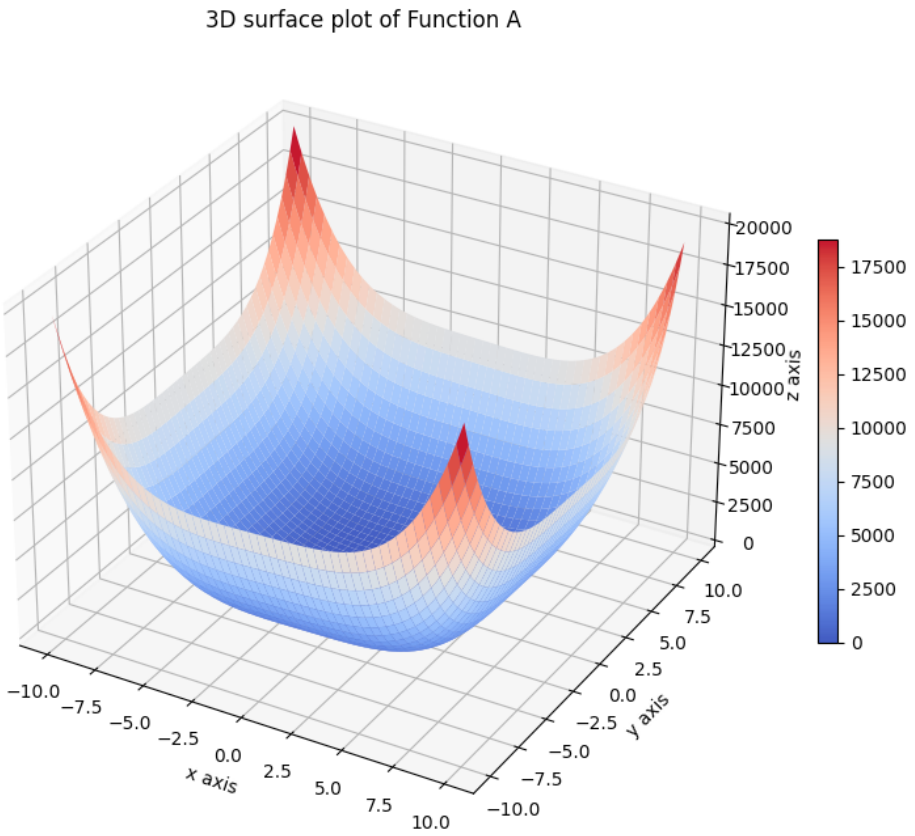
Link del repositorio:

https://github.com/arr19422/Tarea3-IA

Ejercicio 1:

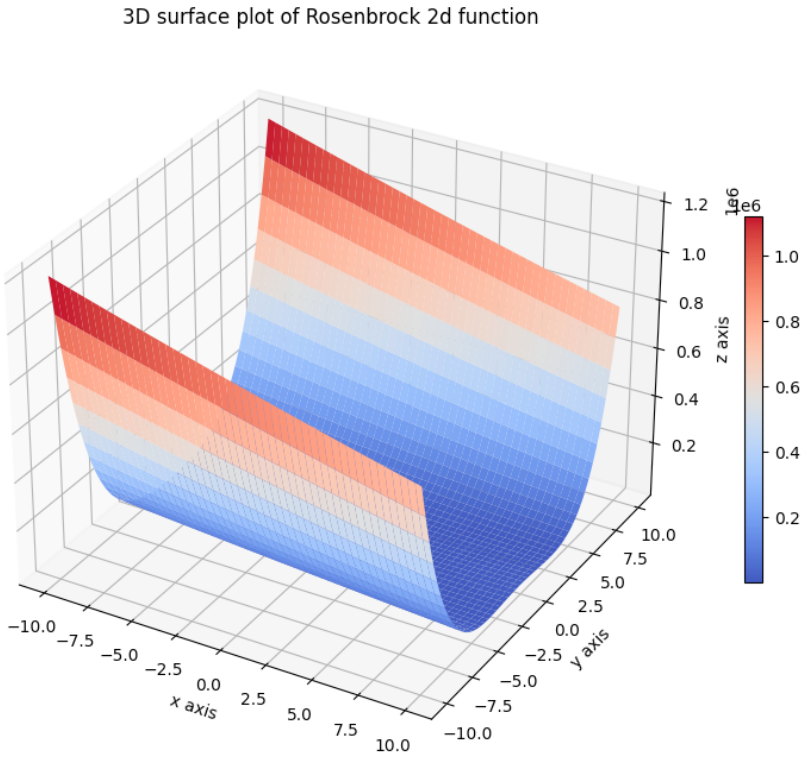
Función: $x^{\wedge 4} + y^{\wedge 4} - 4xy + 0.5y + 1$



Utilizando algoritmo de descenso para puntos (-0.5, 0.2), tamaño de paso 0.002 y 100 iteraciones.

```
[array([-0.24608329,  0.04188297]) 1.0658385066792535]
[array([-0.24384076,  0.0389049 ]) 1.0609364332948792]
[array([-0.24167374,  0.03594664]) 1.0561357014768358]
[array([-0.23957941,  0.0330073 ]) 1.0514308791991809]
[array([-0.23755517,  0.03008606]) 1.0468168701992513]
[array([-0.23559853,  0.02718213]) 1.0422888877207865]
[array([-0.23370718,  0.02429478]) 1.0378424307965681]
[array([-0.23187892,  0.02142328]) 1.033473262787988]
[array([-0.23011168,  0.01856699]) 1.0291773919347518]
[array([-0.2284035 ,  0.01572528]) 1.0249510536986324]
[array([-0.22675253,  0.01289755]) 1.0207906947116243]
[array([-0.22515701,  0.01008326]) 1.0166929581616624]
[array([-0.22361529,  0.00728187]) 1.0126546704687969]
[array([-0.22212579,  0.0044929 ]) 1.0086728291218388]
[array([-0.22068701,  0.00171588]) 1.004744591560354]
[array([-0.21929753, -0.00104961]) 1.0008672649998516]
[array([-0.217956  , -0.00380399]) 0.9970382971093266]
[array([-0.21666112, -0.00654764]) 0.9932552674602166]
[array([-0.21541168, -0.00928089]) 0.9895158796745118]
[array([-0.21420649, -0.01200408]) 0.9858179542073868]
[array([-0.19704526, -0.06975109]) 0.9116791609570671]
[array([-0.19662398, -0.07228402]) 0.9085288801099862]
[array([-0.19622924, -0.07480866]) 0.9053911026273277]
[array([-0.19586054, -0.07732491]) 0.9022652921701211]
[array([-0.19551742, -0.07983262]) 0.8991509508863537]
[array([-0.1951994 , -0.08233163]) 0.8960476182772981]
[array([-0.19490603, -0.08482179]) 0.8929548701118348]
[array([-0.19463687, -0.08730292]) 0.8898723173836848]
[array([-0.19439149, -0.08977485]) 0.8867996053068335]
[array([-0.19416944, -0.09223737]) 0.8837364123447717]
[array([-0.19397031, -0.09469028]) 0.880682449269501]
[array([-0.19379368, -0.09713336]) 0.8776374582465585]
[array([-0.19363915, -0.09956641]) 0.874601211942603]
[array([-0.19350631, -0.10198918]) 0.8715735126523826]
[array([-0.19339476, -0.10440144]) 0.8685541914421622]
[array([-0.19330412, -0.10680294]) 0.8655431073069428]
[array([-0.19323399, -0.10919343]) 0.8625401463390451]
[array([-0.19318398, -0.11157266]) 0.8595452209058554]
[array([-0.19315373, -0.11394035]) 0.8565582688347592]]
El minimo es: 0.8565582688347592 en el punto: [-0.19315373 -0.11394035]
```

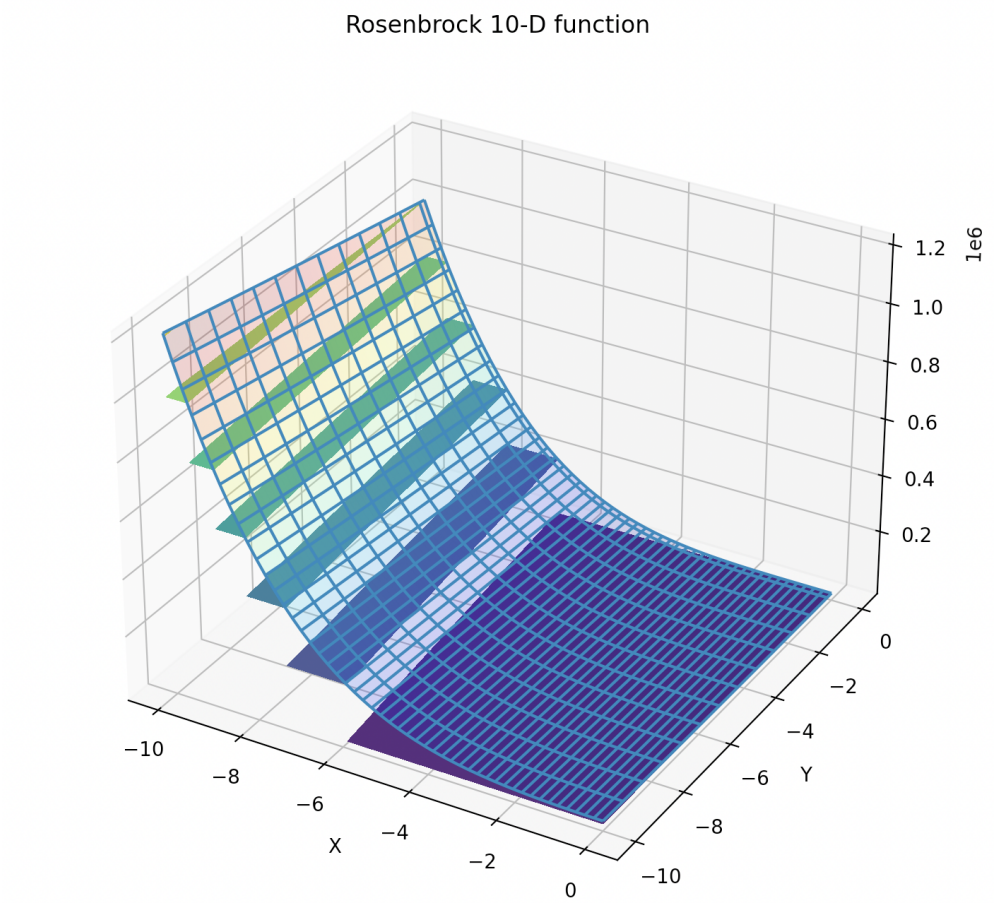
Función: $100(x_2 - x_1\text{^}2)\text{^}2 + (1 - x_i)\text{^}2$



Utilizando algoritmo de descenso para puntos (-0.4, 0.1), tamaño de paso 0.001 y 100 iteraciones.

```
[array([0.67035527, 0.27775268]) 3.0541285725060394]
[array([0.70134005, 0.31207738]) 3.322019104103489]
[array([0.72999079, 0.34803748]) 3.4898229346510115]
[array([0.75615857, 0.38500729]) 3.5477053956570854]
[array([0.77987815, 0.42236099]) 3.502436481748885]
[array([0.80129506, 0.45953078]) 3.3716783317132264]
[array([0.82060129, 0.49603938]) 3.177383231986274]
[array([0.8379961, 0.5315088]) 2.9410729794258335]
[array([0.85366864, 0.56565453]) 2.681431137265319]
[array([0.8677924 , 0.59827365]) 2.4134733109033077]
[array([0.88052433, 0.62923166]) 2.148545482314828]
[array([0.89200558, 0.65844994]) 1.894705798488526]
[array([0.90236273, 0.68589475]) 1.6572582228063983]
[array([0.91170914, 0.7115675 ]) 1.4393133914393808]
[array([0.92014633, 0.73549671]) 1.2423103608906958]
[array([0.92776518, 0.75773122]) 1.0664683082773647]
[array([0.93464713, 0.77833462]) 0.9111584430864786]
[array([0.94086518, 0.79738075]) 0.7751983357860269]
[array([0.94648481, 0.81495006]) 0.6570769142860773]
[array([0.9515648 , 0.83112675]) 0.5551207978683953]
[array([0.95615797, 0.84599651]) 0.4676129466998283]
[array([0.96031177, 0.85964482]) 0.39287378517203014]
[array([0.9640689 , 0.87215559]) 0.3293136218542997]
[array([0.96746781, 0.88361024]) 0.27546370261865694]
[array([0.97054309, 0.89408699]) 0.229991799537395]
[array([0.97332595, 0.90366037]) 0.1917069573877081]
[array([0.97584448, 0.91240097]) 0.15955693105585148]
[array([0.97812405, 0.92037527]) 0.1326209543437807]
[array([0.98018755, 0.92764555]) 0.11009976847041296]
[array([0.98205562, 0.93426997]) 0.0913042833903479]
[array([0.98374691, 0.94030262]) 0.07564382108937334]
[array([0.98527826, 0.94579369]) 0.06261457246081215]
[array([0.9866649, 0.9507896]) 0.05178866609120836]
[array([0.98792057, 0.95533321]) 0.04280407944110808]
[array([0.98905772, 0.95946398]) 0.035355504968454445]
[array([0.99008757, 0.96321822]) 0.029186203230962833]]
El minimo es: 0.029186203230962833 en el punto: [0.99008757 0.96321822]
```

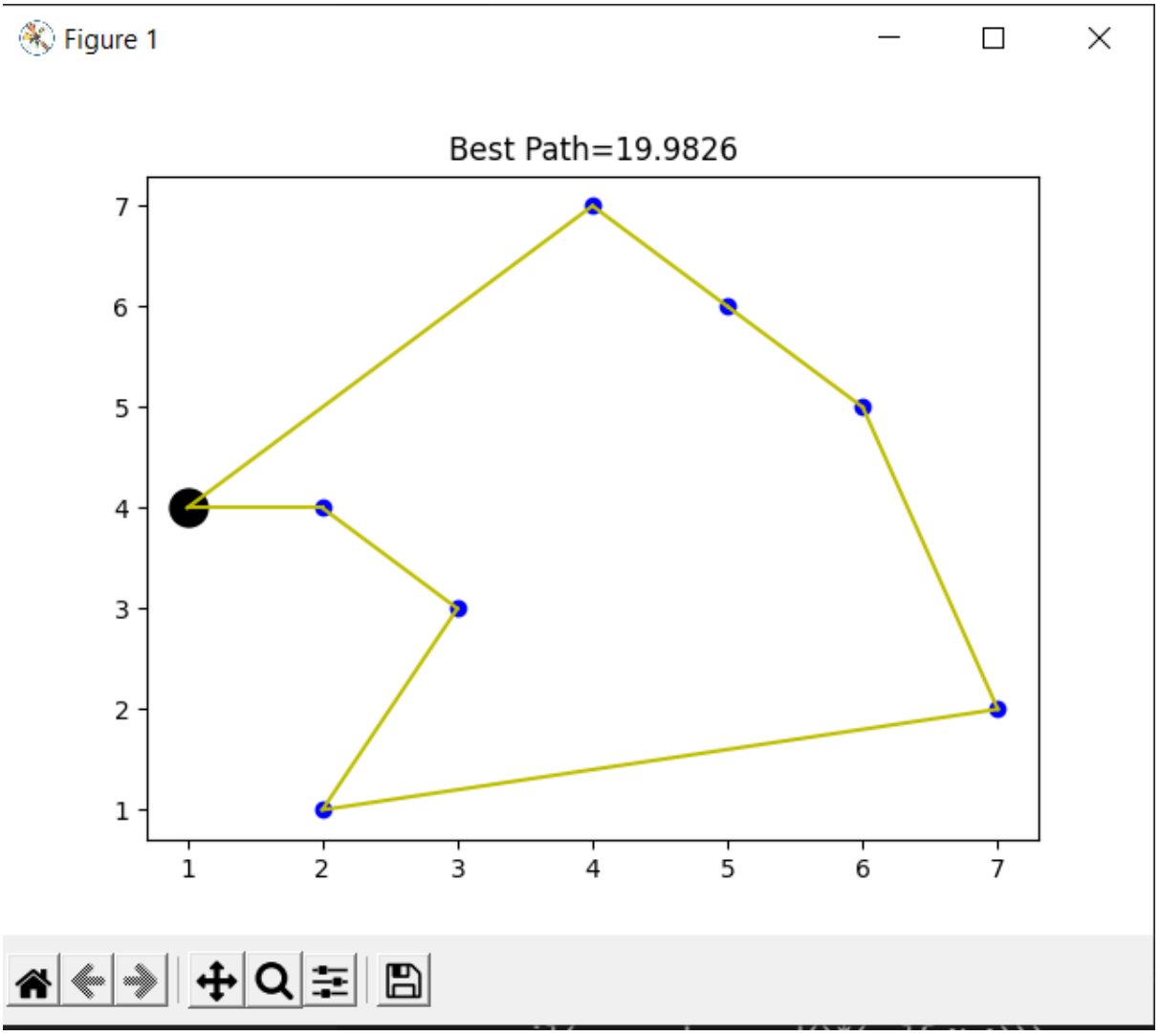
Función $\sum_{i=1}^{9} [100(x_2 - x_1\text{^}2)\text{^}2 + (1 - x_i)\text{^}2]$



Utilizando algoritmo de descenso para puntos (-10,0), tamaño de paso 0.2 y 100 iteraciones.

```
El minimo es: [1.21012100e+06 1.11854833e+06 1.03227002e+06 9.51078105e+05
 8.74768808e+05 8.03142500e+05 7.36003719e+05 6.73161167e+05
 6.14427706e+05 5.59620366e+05 5.08560336e+05 4.61072971e+05
 4.16987787e+05 3.76138465e+05 3.38362849e+05 3.03502945e+05
 2.71404923e+05 2.41919116e+05 2.14900021e+05 1.90206296e+05
 1.67700765e+05 1.47250413e+05 1.28726389e+05 1.12004007e+05
 9.69627402e+04 8.34862286e+04 7.14622736e+04 6.07828403e+04
 5.13440571e+04 4.30462152e+04 3.57937694e+04 2.94953375e+04
 2.40637004e+04 1.94158026e+04 1.54727513e+04 1.21598172e+04
 9.40643405e+03 7.14619897e+03 5.31687211e+03 3.86037690e+03
 2.72279992e+03 1.85439099e+03 1.20956310e+03 7.46892439e+02
 4.29118403e+02 2.23143578e+02 1.00033746e+02 3.50178889e+01
 7.48818233e+00 1.00000000e+00] en el punto: (array([[-10.        ,  -9.795
        -0.20408163,   0.        ],
       [-10.        ,  -9.79591837,  -9.59183673, ...,  -0.40816327,
        -0.20408163,   0.        ],
       [-10.        ,  -9.79591837,  -9.59183673, ...,  -0.40816327,
        -0.20408163,   0.        ],
       ...,
       [-10.        ,  -9.79591837,  -9.59183673, ...,  -0.40816327,
        -0.20408163,   0.        ],
       [-10.        ,  -9.79591837,  -9.59183673, ...,  -0.40816327,
        -0.20408163,   0.        ],
       [-10.        ,  -9.79591837,  -9.59183673, ...,  -0.40816327,
        -0.20408163,   0.        ]]), array([[-10.        , -10.        ,
       -10.        , -10.        ],
       [ -9.79591837,  -9.79591837,  -9.79591837, ...,  -9.79591837,
        -9.79591837,  -9.79591837],
       [ -9.59183673,  -9.59183673,  -9.59183673, ...,  -9.59183673,
        -9.59183673,  -9.59183673],
       ...,
       [ -0.40816327,  -0.40816327,  -0.40816327, ...,  -0.40816327,
        -0.40816327,  -0.40816327],
       [ -0.20408163,  -0.20408163,  -0.20408163, ...,  -0.20408163,
        -0.20408163,  -0.20408163],
       [  0.        ,   0.        ,   0.        , ...,   0.        ,
         0.        ,   0.        ]]))
```

Ejercicio 2:




```
Best Path:19.982646525499522
0=>3=>1=>5=>4=>6=>7=>2=>0
```